

FOSSIL POLLEN GRAINS OF *NOTHOFAGUS* FROM AUSTRALIA

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**Abstract**

Pollen grains belonging to ten Tertiary species of *Nothofagus* are described and illustrated.

**Introduction**

Following the first record of pollen grains of *Nothofagus* in Australian Tertiary deposits (Cookson 1945), ten forms were described from sediments in the south-eastern region of Australia (Cookson 1946). However, the forms then recognized were not given formal specific names but were distinguished by individual letters of the alphabet.

As this type of nomenclature is not in accordance with the International Rules of Nomenclature, it is now proposed to give these forms specific names and to nominate a type specimen for each. To save unnecessary repetition, the reader is referred to the 1946 paper, cited above, for details not essential to the diagnoses given herein, as well as for additional illustrations and lists of occurrences.

It is now well known that three morphological types of pollen groups occur among the living species of *Nothofagus* (Cookson and Pike 1955, p. 198), the *menziesii* and *fusca* types (Cranwell 1939) and the *brassi* type (Cookson and Pike 1955). All three types are represented in the Tertiary deposits of eastern Australia but in Western Australia only the *brassi* type has been observed as yet (Cookson 1954).

**Descriptions of Australian Fossil Pollen Grains of  
*Nothofagus***

- A. The *menziesii* pollen type, characterized by large size, delicate exine and unrimmed equatorial fissures.

***Nothofagus aspera* sp. nov.**

(Pl. IV, figs. 1, 2: holotype, fig. 1)

*Nothofagus* sp. a Cookson 1946. *Proc. Linn. Soc. N.S.W.* 71: 53, Pl. I, figs. 5-7; Fig. 2, Table 1.

DIAGNOSIS: Equatorial diameter 40-60 $\mu$ , average 52 $\mu$ , circular to slightly angular in polar view with, in unruptured grains, the position of the 'fissure points' faintly indicated around the equator. Usually the fissures, which are 6-9 in number, majority 7, gape widely.

The exine is less than 1 $\mu$  thick and completely covered with small spinules which can be seen projecting beyond the surface in optical sections at a magnification of c. 600 diameters.

TYPE LOCALITY: Vegetable Creek (Emmaville), New South Wales. Melb. Univ. Geol. Dept. (M.U.G.D.) Specimen No. 890.

GEOLOGICAL RANGE: Eocene to Pliocene.

COMMENTS: *N. aspera* agrees closely with the pollen of the living species *N. cunninghamii* (Hook) Oerst. of Victoria and Tasmania, *N. moorei* (F. Muell.) Maiden of north-eastern New South Wales and south-eastern Queensland and *N. menziesii* Oerst. of New Zealand. It approaches most closely the pollen of *N. moorei* as regards the distribution of the exinous spinules.

- B. The *fusca* type, characterized by medium size, biconvexity, and thickening of exine around the pore. The apertures, although  $\pm$  colpoid, are referred to as pores on account of their rounded ends (Faegri and Iversen 1950).

1. *Nothofagus brachyspinulosa* sp. nov.

(Pl. IV, fig. 4)

*Nothofagus* sp. b Cookson 1946. *Proc. Linn. Soc. N.S.W.* 71: 53, Pl. I, figs. 8-13; Fig. 3, Table 2.

DIAGNOSIS: Grain biconvex, typically circular in polar view, equatorial diameter 22-40 $\mu$ , average 30 $\mu$ ; pores 5-9, mainly 6 and 7, majority 7. Exine *c.* 1.5 $\mu$  thick between the pores, 2.2-6 $\mu$  at the pores. Spinules very short and moderately dense.

TYPE LOCALITY: Vegetable Creek (Emmaville), New South Wales. M.U.G.D. Specimen No. 890.

GEOLOGICAL RANGE: Eocene to Lower Miocene.

COMMENTS: *N. brachyspinulosa* is a very rare species.

2. *Nothofagus cincta* sp. nov.

(Pl. IV, fig. 3)

*Nothofagus* sp. c Cookson 1946. *Proc. Linn. Soc. N.S.W.* 71: 55, Pl. I, figs. 17, 18; Fig. 4, Table 3.

DIAGNOSIS: Grain large, circular to slightly angular in polar view, equatorial diameter 27-64 $\mu$ , average *c.* 40 $\mu$ ; pores 5-8, occasionally 4, mainly 6 and 7. Exine *c.* 1 $\mu$  thick, 3-4 $\mu$  at the pores; spinules fine and short, generally inconspicuous so that the exine appears smooth in optical section under oil immersion.

TYPE LOCALITY: Vegetable Creek (Emmaville), New South Wales. M.U.G.D. Specimen No. 890.

GEOLOGICAL RANGE: Eocene to Lower Miocene.

- C. The *brassi* type, characterized by small to medium size, usually angular amb and uniform thickness of the exine.

1. *Nothofagus emarcida* sp. nov.

(Pl. IV, figs. 7, 8; holotype, fig. 7. Fig. 1)

*Nothofagus* sp. c Cookson 1946. *Proc. Linn. Soc. N.S.W.* 71: 56, Pl. II, figs. 22-25; Fig. 6, Table 5.

DIAGNOSIS: Grain flattened with a strongly angular amb, sides straight to slightly concave, equatorial diameter 19-42 $\mu$ ; pores 4-7, mainly 5 and 6, majority 6. Exine of uniform thickness, *c.* 1 $\mu$ , forming unthickened rims around the pores; spinules numerous, fine, usually less crowded towards the equator, just visible in optical section at a magnification of *c.* 650 diameters.

TYPE LOCALITY: Clay at base of Yallourn brown coal seam, Yallourn, Victoria.

GEOLOGICAL RANGE: Eocene to Lower Miocene.

COMMENTS: *N. emarcida* is one of the most widespread and most abundant of the fossil species. It was the likeness of this species to pollen of *N. grandis* Steen. from Aiyura, New Guinea, which led to the identification of the majority of the Australian Tertiary species with the section Bipartitae now represented only in New Guinea and New Caledonia (Cookson 1952).

## 2. *Nothofagus falcata* sp. nov.

(Pl. IV, fig. 14. Figs. 3, 4)

*Nothofagus* sp. f Cookson 1946. *Proc. Linn. Soc. N.S.W.* 71: 57, Pl. II, figs. 26-29; Fig. 7, Table 6.

DIAGNOSIS: Grain slightly biconvex with a prominent angular amb; equatorial diameter 26-47 $\mu$ , average *c.* 34 $\mu$ ; pores 4-7, mainly 5 and 6. Exine *c.* 2 $\mu$ , frequently embayed between the pores; spinules short, becoming smaller towards the equator of the grain, widely spaced (1.5-2 $\mu$ ), visible in optical section at a magnification of *c.* 650 diameters.

TYPE LOCALITY: Brown coal, Altona, Victoria.

GEOLOGICAL RANGE: Eocene to Lower Miocene.

COMMENTS: *N. falcata* can be distinguished from *N. emarcida* by the thicker exine, more widely spaced spinules and the frequent embayment of the exine between the pores.

## 3. *Nothofagus hetera* sp. nov.

(Pl. IV, figs. 9, 10; holotype, fig. 9. Fig. 2)

*Nothofagus* sp. h Cookson 1946. *Proc. Linn. Soc. N.S.W.* 71: 58, Pl. II, figs. 33-35; Fig. 9, Table 8.

DIAGNOSIS: Grain flattened, amb somewhat angular; equatorial diameter 27-48 $\mu$ , average *c.* 35 $\mu$ ; pores 6-9, mainly 7 and 8, majority 7. Exine *c.* 1 $\mu$ , firm, forming narrow rims to the pores which are usually rather widely open. Spinules moderately fine and dense, just visible in optical section at magnification of *c.* 650 diameters, coarser and closer at the poles.

TYPE LOCALITY: Balcombe Bay, leaf beds, Victoria.

GEOLOGICAL RANGE: Eocene to Lower Miocene.

COMMENTS: *N. hetera* can be distinguished from *N. emarcida* by the higher pore-number, the less angular amb and slightly coarser sculpture.

## 4. *Nothofagus incrassata* sp. nov.

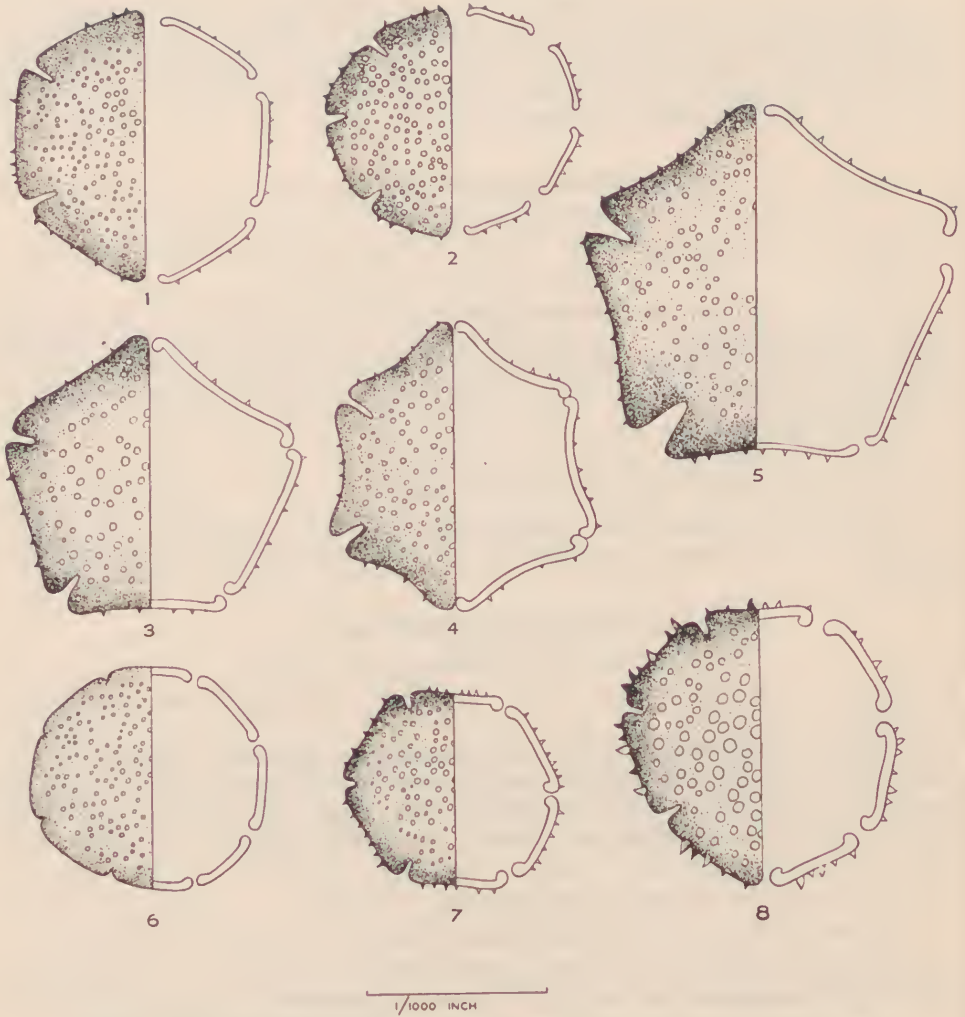
(Pl. IV, fig. 13. Fig. 6)

*Nothofagus* sp. i Cookson 1946. *Proc. Linn. Soc. N.S.W.* 71: 59, Pl. II, figs. 36-38; Fig. 10.

DIAGNOSIS: Grain slightly biconvex, amb circular to slightly angular, equatorial diameter 27-48 $\mu$ , average 36 $\mu$ ; pores 6-9, majority 7. Exine firm, *c.* 2 $\mu$ , forming rims of the same thickness around the pores, smooth in optical section at a magnification of *c.* 650 diameters, spinules short and moderately dense.

TYPE LOCALITY: Melrose, South Australia, South Australian Department of Mines Bore, 486-7 ft.

GEOLOGICAL RANGE: Eocene.



Camera lucida drawings of fossil pollen grains of the *brassi* type in polar view.  
 FIG. 1.—*Nothofagus emarcida*. FIG. 2.—*N. hetera*. FIGS. 3-4.—*N. falcata*. FIG. 5.—*N. goniata*.  
 FIG. 6.—*N. incrassata*. FIG. 7.—*N. diminuta*. FIG. 8.—*N. vansteenisii*.

5. *Nothofagus goniata* sp. nov.

(Pl. IV, figs. 5, 6; holotype, fig. 5. Fig. 5)

*Nothofagus* sp. g Cookson 1946. *Proc. Linn. Soc. N.S.W.* 71: 58, Pl. II, figs. 30-32; Fig. 8, Table 7.

DIAGNOSIS: Grain large, considerably flattened with a strongly angular amb; equatorial diameter 32-59 $\mu$ , average 40-45 $\mu$ ; pores 4-7, majority 5 and 6. Exine delicate *c.* 1 $\mu$ ; spinules rather widely spaced, 2-3 $\mu$  apart, fine and sharp, readily visible in optical section at a magnification of *c.* 650 diameters.

TYPE LOCALITY: Vegetable Creek, New South Wales. M.U.G.D. Specimen No. 189.

GEOLOGICAL RANGE: Lower Tertiary.

COMMENTS: Since the earlier statement regarding the affinity of *N. goniata* still applies it is quoted here *in toto*. "On account of the delicate nature of the exine some difficulty was experienced in deciding whether the deep gaps, evident in every grain, represent fissures or widely open predetermined narrow-rimmed pore-slits related to functional pores. The latter view, adopted after careful examination of the Vegetable Creek form, has been confirmed by examples in preparations of lignite from Beenak. In these the exine is slightly thicker and the rims of the pore-slits more distinct".

The example of *N. goniata* shown in Pl. IV, fig. 6, confirms the present association with the *brassi* type rather than with the *mensiesii* type which in some respects it resembles rather closely. In this example the pores, though closed, have a clearly defined border.

#### 6. *Nothofagus deminuta* sp. nov.

(Pl. IV, fig. 12. Fig. 7)

*Nothofagus* sp. *d* Cookson 1946. *Proc. Linn. Soc. N.S.W.* 71: 55, Pl. I, figs. 19-21; Fig. 5, Table 4.

DIAGNOSIS: Grain with somewhat convex polar surfaces and a circular to slightly angular amb; equatorial diameter 18-35 $\mu$ , average 26 $\mu$ ; pores 5-8, mainly 6 and 7. Exine firm, of uniform thickness; spinules slender, *c.* 1 $\mu$  long, rather closely arranged and slightly smaller towards the equator.

TYPE LOCALITY: Brown coal, Altona, Victoria.

GEOLOGICAL RANGE: Eocene to Lower Miocene.

COMMENTS: In the original description of this species the exine was said to be thickened around the pores. A careful re-examination has shown that this is not the case and that *N. deminuta* is of the *brassi* and not the *fusca* type as previously suggested. It is one of the smallest of the Australian types and is readily distinguishable by its  $\pm$  circular outline, proportionately thick exine and relatively long spinules.

#### 7. *Nothofagus vansteenisi* sp. nov.

(Pl. IV, fig. 11. Fig. 8)

*Nothofagus* sp. *j* Cookson 1946. *Proc. Linn. Soc. N.S.W.* 71: 59, Pl. II, figs. 39-45; Fig. 11.

DIAGNOSIS: Grain flattened with a strongly angular amb; equatorial diameter 27-40 $\mu$ , average *c.* 34 $\mu$ ; pores 5-9, majority 7, the frequencies of 6- and 8-pored specimens varying in preparations of different deposits. Exine firm, *c.* 1.5-2 $\mu$  thick; spinules relatively coarse, larger at the poles where the basal diameter is up to 2.5 $\mu$ .

TYPE LOCALITY: Brown coal, Altona, Victoria.

GEOLOGICAL RANGE: Eocene to Lower Miocene.

COMMENTS: This species is named in honour of Professor C.G.G.J. van Steenis, whose interest in and work on the section Bipartitae of genus *Nothofagus* is well known.

*N. vansteenisi* approaches most closely to *N. deminuta* but can be distinguished from this species by its larger size, more angular amb, and coarser sculpture.

## References

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## Explanation of Plate IV

Registered numbers in the palaeobotanical collection of the National Museum of Victoria are given.

- Figs. 1, 2.—*Nothofagus aspera* sp. nov., Vegetable Creek, N.S.W. Fig. 1, holotype. P17660.  
 Fig. 2, paratype with open fissures. P17663.  
 Fig. 3.—*Nothofagus cincta* sp. nov. Holotype, Vegetable Creek, N.S.W. P17662.  
 Fig. 4.—*Nothofagus brachyspinulosa* sp. nov. Holotype, Vegetable Creek, N.S.W. P17661.  
 Figs. 5, 6.—*Nothofagus goniata* sp. nov., Vegetable Creek, N.S.W. Fig. 5, holotype. P17666.  
 Fig. 6, paratype. P17667.  
 Figs. 7, 8.—*Nothofagus emarcida* sp. nov., Yallourn, Victoria. Fig. 7, holotype. P17668. Fig. 8, paratype. P17669.  
 Fig. 9.—*Nothofagus hetera* sp. nov. Holotype, Balcombe Bay, Victoria, P17671.  
 Fig. 10.—*Nothofagus hetera* sp. nov. Paratype, Brown coal, Moorlands, S.A. P17672.  
 Fig. 11.—*Nothofagus vansteenisii* sp. nov. Holotype, Brown coal, Altona, Victoria. P17664.  
 Fig. 12.—*Nothofagus diminuta* sp. nov. Holotype, Brown coal, Altona, Victoria. P17673.  
 Fig. 13.—*Nothofagus incrassata* sp. nov. Holotype, Melrose Bore, S.A., 486-7 ft. P17674.  
 Fig. 14.—*Nothofagus falcata* sp. nov. Holotype, Altona, Victoria. P17665.